

## RESEARCH ITEMS

## Production of Cancer by Ultra-violet Irradiation

THIS topic was discussed by H. P. Rusch and B. E. Kline at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13-15. The idea that sunlight is an important causal agent in cancer of the skin is not new. The high incidence of skin cancer in sailors has long been known, and nearly fifty years ago 'seaman's skin' was described as a precancerous condition attributable to continued exposure to light. However, only in the last decade has experimental support been formed for the theory of direct causation of cancer by sunlight. The authors have determined the wave-lengths of the spectrum responsible for cancer production and measured the amount of energy required for the process. White mice were used in these studies. The wave-lengths responsible were found to lie between 2,900 Å. and 3,341 Å. The minimum time for the development of tumours was about two and a half months, and it was not necessary to irradiate the animals throughout the precancerous period. Once initiated, carcinogenesis proceeded without further exposure, and sometimes several months elapsed between the end of irradiation and the appearance of tumours. Very little radiant energy was needed to initiate those changes which culminate in tumour formation. The tumours produced were true malignant cancers of the same type found in humans.

## Controlling the Micropopulation of the Soil

IN a paper read at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13-15, C. Thorn of the U.S. Bureau of Plant Industry reviewed experimental work towards control or direction of the microbial activities of the soil to produce desired ends. The destruction of waste plant and animal matter by soil micro-organisms is the function of the soil micropopulation most commonly understood. Variations from comparatively small totals to fabulous numbers of soil organisms were recorded. There arises the possibility of controlling this capacity of the normal groups represented in the population to multiply with great rapidity, in such a manner as to produce great decomposing power at selected times and for our purposes. For example, such activity may either rob a root parasite of available nutrients or actually destroy the parasite. Application of the principles developed in the control of take-all of wheat and cotton root rot were discussed.

## Gardeners and the Moon

MANY practical gardeners insist that some plants grow best from seeds sown at a particular phase of the moon. K. Mather and J. Newell have obtained some experimental evidence on this question (*J. Roy. Hort. Soc.*, 66, Pt. 10, Oct., 1941). There is apparently no consistent lunar effect upon germination; but it is unfortunate that the authors do not appear to trust their results in one experiment where a marked effect of the April full moon was demonstrated. The work requires to be repeated many times, with full measurements of lunar radiation and of other climatic factors, for the problem is one involving the microclimate round a plant—it is far more than the investigation of an astrologically inspired opinion.

## Fungus Diseases of the Carrot

THE tenth part of a series of articles by D. E. Green on "Hygiene in the War-time Vegetable Garden" (*J. Roy. Hort. Soc.*, 66, Pt. 11, Nov., 1941) contains a short reference to several diseases of carrots, information about which is not readily available. Black rot, *Alternaria radicina*, violet root rot, *Helicobasidium purpureum*, storage rot, *Sclerotinia sclerotiorum*, and soft rot, *Bacterium carotovorum*, are briefly described.

## Vitamin C and Respiration

IN 1933, Harrison, in exploring the possible connexion between tissue respiration and *L*-ascorbic acid, found that addition of the vitamin to liver tissues of scorbutic animals increases their *in vitro* oxygen uptake. G. A. Snow and S. S. Zilva (*Biochem. J.*, 35, 783, 787; 1941), in studying this phenomenon in greater detail, now find that the respiration of liver slices from guinea-pigs maintained on a quantitatively restricted diet (containing, however, ample vitamin C) is indeed considerably increased by the addition of ascorbic acid. Furthermore, the stimulating action on the respiration is not confined to ascorbic acid alone, but can be brought about by the presence of chemically related compounds, such as *D*-gluco-ascorbic acid and reductic acid, which possess a similar reduction potential but no ascorbic activity. The inhibition by phloridzin and pyrophosphate and the failure of cyanide, iodoacetate and malonate to inhibit the above accelerated respiration produced by ascorbate on the liver tissue of underfed animals indicates that this increased respiration may be connected with any of the stages concerned in the anaerobic formation of trisophosphate from glycogen or in the aerobic degradation of the intermediate products, but not with the compounds formed by the anaerobic breakdown of trisophosphate.

## Seismic Activity since 1904

SEISMIC activity in the twentieth century has recently been discussed by B. Gutenberg and C. F. Richter ("Seismicity of the Earth", by Beno Gutenberg and C. F. Richter, Geological Society of America, Special Paper No. 34, August 30, 1941). The data are chiefly instrumental concerning shallow shocks, though some new data on deep focus shocks are included. 54 great shocks during 1904-39 have been given revised epicentres, all large shocks from 1926 until 1933 are listed, and many other epicentres are given. Much of the data comes from the International Seismological Summary. The authors suggest that the earth's surface consists of relatively inactive blocks separated by active zones of three groups: (1) the circum-Pacific zone, which contains many shallow shocks, many intermediate depth shocks, and all the very deep shocks; (2) the Mediterranean and trans-Asiatic zone; (3) narrow belts of shallow shocks which extend (a) through the Arctic and Atlantic Oceans, following the mid-Atlantic ridge, (b) through the western Indian Ocean from Arabia into the Antarctic, (c) the African rift valleys. Gutenberg and Richter suggest that the annual average includes about one great shock, about a hundred potentially destructive shocks, and about one million shocks potentially strong enough to be felt in a settled area. Seismic energy is released at a mean rate of about  $10^7$  kilowatts, most of it in

the large shocks. It is possible that the persistence of oceanic troughs and gravity anomalies, together with the occurrence of earthquakes, requires that in the regions affected there is a continuously operating mechanism, such as would be provided by constant subcrustal flow.

#### Hydrocarbon Flames in Atomic Oxygen

A RE-EXAMINATION by K. H. Geib and W. M. Vaidya (*Proc. Roy. Soc., A*, 178, 351; 1941) of the flames of hydrocarbons burning in atomic oxygen shows that the ethylene bonds are strong in benzene and acetylene, but are weak and diffuse in ethylene.  $C_2$ , CH and HO are also present. Methyl alcohol gives the HO and CH bonds and also 'cool flame' bonds rather faintly, while formaldehyde shows only the HO bond at  $\lambda 3064$ . The ethylene flame bonds are absent from the flame of benzene burning in atomic hydrogen, which yields only  $C_2$  and CH bonds. The Balmer lines also appear, however, due to stray light from the main discharge.

#### Fission Yield by Fast Neutrons

THE 1,100-kv. tube of the Instituto di Sanità Pubblica at Rome was used by a group of workers, M. Ageno, E. Amaldi, D. Bocciarelli, B. N. Cacciapuoti and G. C. Trabacchi, for measurements of the fission cross-section of uranium for neutrons produced in the reactions  $Rn + Be$ ,  $D + C$ ,  $D + D$ ,  $D + Be$ ,  $D + B$  and  $D + Li$  (*Phys. Rev.*, 60, 67; 1941). From the fact that the mean cross-section has about the same value for neutrons of the  $D + D$ ,  $D + Be$ ,  $D + B$  reactions, it was concluded that the fission cross-section has a value  $\sigma_f$  which remains nearly constant between 1 and 10 Mev. For neutrons of the  $Rn + Be$  and  $D + C$  reactions the fission cross-sections seem to be, respectively, about  $\frac{1}{2} \sigma_f$  and  $\frac{1}{3} \sigma_f$ . Finally, for neutrons of the  $D + Li$  reaction the mean cross-section is  $1.4 \sigma_f$ . This fact was interpreted by N. Bohr as due to successive transformations which are possible for energies of the impinging neutrons larger than 10 Mev. A similar increase of the fission cross-section was observed also for thorium, in very good agreement with the theoretical predictions of Bohr.

#### The Mills-Nixon Effect

THE bond angles in a molecule containing a saturated 5- or 6-membered ring fused to a benzene ring cannot have the normal values in the aliphatic and aromatic portions. W. H. Mills and I. G. Nixon, in 1930, inferred from substitution experiments that the double bonds in hydrindene and tetralin are frozen to the particular Kekulé structure in which the bond angles are the least strained. This conclusion is somewhat modified in detail by taking account of excited ionic resonance states of the benzene molecule, and in 1935 L. E. Sutton and L. Pauling published an approximate quantum mechanical treatment which showed that theory predicts a relatively small stabilization of one Kekulé structure in hydrindene and in tetralin. An investigation of 1,3,5-tribromobenzene, *o*-dibromoxylene, *o*-dibromohydrindene and *o*-dibromotetralin by the electron diffraction method, made by A. Kossiakoff and H. D. Springall (*J. Amer. Chem. Soc.*, 63, 2223; 1941) has given some interesting results. It is shown that the complete fixation of the double bonds in the hydrindene or the tetralin compound is excluded, that there is a large amount of double-bond character for the C-Br bond in the bromobenzenes, particularly in the hydrindene derivatives, which throws light on the relative import-

ance of the excited ionic states, and that the effect of strain on the benzene molecule (Mills-Nixon effect) is primarily concerned with changes in the contributions of excited states of the molecule rather than with fixation of double bonds into a particular Kekulé structure. In agreement with Sutton and Pauling's calculations, the change in external bond angles of the benzene ring caused by the fusion of a saturated ring is shown to be very small.

#### Space Motions of Solar Prominences

THE first exhaustive study of the structure of solar prominences in the three space co-ordinates  $x$ ,  $y$ ,  $z$  is reported from the McMath-Hulbert Observatory (*Pub. Obs. Univ. Michigan*, 8, 123; 1941). From nearly 2,000  $H\alpha$  spectroheliograms of a prominence on September 20, 1940, taken on motion-picture film with two spectroheliographs (one for cross-motions and one for radial velocities), the parameters  $x$ ,  $y$ ,  $dz/dt$ , and  $t$  are measured for four easily identified prominence knots. For each knot a process of graphical integration then gives the true space motion as a function of  $t$ . The only difficulty, that of arriving at  $z$  from  $dz/dt$ , is ingeniously solved by making an approximate estimate of the constant of integration from subsequent observations of the prominence as a dark marking projected on the disk. From the data thus derived, a model of the prominence has been constructed; and photographs of this model taken from various angles show a close resemblance to frequently observed prominence forms. The accelerations derived from the observed displacements and velocities are of the order of one tenth that due to unopposed gravitation at the solar surface, though for short intervals of time accelerations exceeding the gravitational value have been observed. The radial and cross velocities are of the same order, as would be expected if the observed effects are due to mass motion of the prominence atoms, as distinct from a travelling excitation.

#### Dimensions and Masses of Wolf-Rayet Stars

CECILIA H. PAYNE-GAPOSCHKIN (*Telescope*, May-June) has discussed the star *H.D.* 193576, known to be a spectroscopic binary, and recently found by Dr. S. Gaposchkin at Harvard to be also an eclipsing binary. A considerable amount of speculation had been made about the size and mass of a Wolf-Rayet star; but now, assuming that *H.D.* 193576 is representative of this type, a volume six times and a mass ten times those of the sun can be taken as approximately correct. The bright-line spectra of these stars reveal the presence of highly ionized atoms of the commoner elements, notably helium, carbon, nitrogen and oxygen. The width of these bright lines led to the conjecture of nebular stars of enormous size, because the novæ, which have many points of resemblance to Wolf-Rayet stars, expand to vast dimensions. On the other hand, the displacement from the normal wave-length of these bright lines led to the picture of small, dense stars, the shift arising from the intense gravitational potential. Now that the size and mass are known, both the width and displacement of the lines appear in a new light. It is suggested that the red shift of the bright lines (a phenomenon occurring also in 29 Canis Majoris) is caused by washed-out absorption lines on the violet edges of the bright lines. The gravitational red-shift in a star of size and mass like those just given for a Wolf-Rayet star would be only about one hundredth of what has been observed.